cirrhosis, TIPS is probably a less intrusive bridge to liver transplantation.

In a randomized comparison of TIPS and the small-diameter portacaval H-graft (partial shunt), TIPS resulted in higher incidences of death, rebleeding, and liver failure.

More randomized trials of TIPS versus surgical shunts clearly are needed. Meanwhile, based on current data, the lengthy track record of surgical shunts, and the existing unrandomized trials of TIPS, it seems reasonable to limit the current use of TIPS to a subset of patients with variceal hemorrhage:

- unacceptable candidates for surgical intervention;

- survivors of failed endoscopic and surgical therapy;

- end-stage cirrhotics awaiting hepatic transplantation; or

- unstable patients in emergency situations.

Surgical shunts should be used in cirrhotics with good hepatic reserve who have had one episode of bleeding from varices, in whom endoscopic treatment has been deemed unsuitable or has failed. The evidence favors a shunt that preserves portal perfusion of the liver to minimize the chances of encephalopathy and liver dysfunction.

JOHN CRAIG COLLINS, MD
I. JAMES SARFEH, MD
Irvine, California

REFERENCES

Jalan R, Finlayson NDC, Hayes PC. TIPSS trials: design determines outcome. Hepatology 1997; 26:1361–1365

Jalan R, Forrest EH, Stanley AJ, et al. A randomized trial comparing transjugular intrahepatic portosystemic stent-shunt with variceal band ligation in the prevention of rebleeding from esophageal varices. Hepatology 1997; 26:1115–1122

Collins JC, Sarfeh IJ. Surgical management of variceal hemorrhage. In Conn HO, Palmaz JC, Rösch J, Rössle M (Eds): Transjugular Intrahepatic Portosystemic Shunts. Igaku-Shoin, New York, NY, 1996, pp 35–52

Rosemurgy AS, Goode SE, Zweibel BR, Black TJ, Brady PG. A prospective trial of transjugular intrahepatic portasystemic stent-shunts versus small-diameter prosthetic H-graft portacaval shunts in the treatment of bleeding varices. Ann Surg 1996; 224:378–384

Endovascular Aneurysm Repair

ABOUT 100,000 ABDOMINAL aortic aneurysms and 14,000 descending thoracic aneurysms were diagnosed in the United States in 1984. This number appears to be increasing as the age of our population increases. Aortic aneurysms usually enlarge over time, without accompanying symptoms. If left undetected and untreated, they may rupture, often causing death. Early detection through the screening of high risk patients and elective operative repair of these aneurysms are the keys to the optimal management of this common vascular problem.

Since 1991, the treatment of aortic aneurysms with endovascular stent-graft prostheses has been receiving attention as an alternative to major abdominal surgery. Aneurysm exclusion is performed with a composite stent-graft inserted intraluminally into the aneurysmal aorta from a remote site, usually through the femoral or iliac artery.

Most experience with the use of stent-grafts has been in the treatment of infrarenal abdominal aortic aneurysms. Only about one patient in eight has an abdominal aortic aneurysm configuration with lengths of proximal and distal aortic cuffs able to support a simple tube stent-graft prosthesis. To extend the range of candidates, bifurcated stent-graft prostheses have been developed. Modular stent-graft designs have also been configured to give additional flexibility in transluminal deployment. Transluminally placed endovascular grafts have also been used to treat thoracic aortic aneurysms, aortic dissections, traumatic arterial pseudoaneurysms, traumatic arteriovenous fistulae, and supra- and infrainguinal athero-occlusive disease.

A large number of composite stent-graft devices are in various stages of development; at least eight are in clinical trials. All of these devices share engineering design challenges. The endovascular stent-graft delivery system, either as a simple sheath or a carrying capsule, must be small enough to negotiate the remote artery through which it is inserted. It must also be flexible enough to traverse the often tortuous iliac arteries and lumen of the aneurysm, while avoiding dislodgment and embolization of the laminated thrombus and atheromatous grumous from the aneurysm sac. The graft attachment device must ensure the secure fixation and good apposition to the aortic wall necessary to prevent graft migration, graft detachment, the development of extraluminal channels, and the late development of perianastomotic pseudoaneurysms. This attachment device fixates the graft to the intra-aortic wall with either friction (by pressing against the arterial wall) or some type of hooking mechanism. Ideally, attachment devices should be able to conform to any future potential enlargement of the proximal or distal arteries to which it is juxtaposed. Finally, the graft prosthesis itself must be sufficiently strong to resist dilatation or mechanical breakdown and to allow good tissue incorporation. They have been made mostly from wire forms and Dacron polyester and occasionally from expanded polytetrafluoroethylene (ePTFE) materials, polytetrafluoroethylene (PTFE), or polycarbonate-based polyurethane.

The collaborative efforts of many investigators in this new technology have identified several problems that still must be addressed. Manipulating these devices within the diseased vascular system increases the risk of embolism. The intravascular positioning of these devices may occlude patent lumbar or mesenteric arteries, which may lead to paraplegia and/or visceral ischemia. Or, conversely, these arteries may not occlude, allowing the aneurysm to further enlarge and eventually rupture. Additionally, because most of these grafts are wedged in place, there are risks for perigraft leaking, graft migration, and even delayed aneurysm rupture with insufficient attachment or late dilation of the aorta at the points of fixation. Finally, to fit into these endovascular deployment systems, these graft prostheses must be thin-walled; they may be, however, prone to graft dilatation with loss of integrity over time. When

placed intraluminally, the potential for graft dilatation may be limited by the surrounding aortic wall, but its natural history is yet to be defined.

Nevertheless, transluminally placed endovascular grafts present a less invasive approach to treatment of aneurysms and therefore have tremendous intrinsic appeal. There is need for well controlled clinical trials in which the various transluminally placed endovascular graft devices are compared with standard operative treatment methods in groups of patients with aortic aneurysm morphology and similar risk factors. In particular, these studies will need to document the effective long-term treatment of patients with aneurysms having acceptable early and late patency and morbidity and mortality rates. With cautious optimism, it is conceivable that these endovascular devices may replace anywhere between 30% to 70% of current vascular prosthetic grafts, depending on how effective and safe they prove to be.

ROY M. FUJITANI, MD
Orange, CA

REFERENCES

Green RM, Chuter TAM. Evolution of technologies in endovascular grafting. Cardiovasc Surg 1995; 3:101–107

Dorffner R, Thurnher S, Polterauer P, Kretschmer C, Lammer J. Treatment of abdominal aortic aneurysms with transfemoral placement of stent-grafts: complications and secondary radiologic intervention. Radiology 1997; 204:79–86

Mitchell RS, Dake MD, Semba CP, Fogarty TJ, Zarins CK. Endovascular stent-graft repair of thoracic aneurysms. J Thorac Cardiovasc Surg 1996; 1054–1062

Veith FJ. Transluminally placed endovascular stented grafts (TPEGs) and their impact on vascular surgery (Eastern Vascular Society presidential address). J Vasc Surg 1994; 20:855–860

Current Risks for Blood Borne Viral Illness in Blood Transfusions

SINCE THE DISCOVERY OF the Human Immunodeficiency Virus (HIV) in 1983, there has been tremendous concern regarding the spread of disease through transfusion of blood and blood products. Blood borne viruses causing specific diseases actually have been well known since the 1950s, when epidemiologists determined that Hepatitis B was transmitted through serum. Increasingly sophisticated molecular biology techniques have identified and isolated many more viruses that may be acquired from blood transfusions. The use of these tests to screen blood and eliminate infected units continues to diminish the chances of infecting blood transfusion recipients.

The incidence of transfusion-related HIV infection in the United States has dramatically fallen since testing of all donated blood for HIV-1 and HIV-2 antibodies was initiated in 1985 and 1992, respectively. Of the earliest cases of AIDS (1982 to 1985), 3% were due to contamination of transfused blood products. By 1994, this number had fallen to 1.9%. The decrease is predominately due to testing of donated blood with increasingly more sensitive and more specific assays. It is now estimated that the chances of transfusion-related HIV infection is between 1 in 225,000 (0.00044%) and 1 in 60,000

(0.0017%) per transfused unit. Although perhaps due in small part to the imperfection of screening assays, these chances probably represent blood that was donated during the "window period"—an incubation period in which HIV infection has occurred but the body has initiated no measurable antibody response. The risk of transmission due to HIV infection in the window period has been estimated by the American Red Cross to be approximately 2.6 to 6.5 in 1,000,000 (0.00026% to 0.00065%). New technologies such as polymerase chain reaction (PCR) are being studied to determine how to best identify blood infected with HIV in the incubation period, which will decrease to undetectable levels the chances of HIV infection as a result of blood transfusion.

Until recently, the risk of acquiring hepatitis from blood transfusions was between 8% and 12%. Hepatitis C virus (HCV), a lipid enveloped RNA flavivirus (previously known as non-A, non-B hepatitis), was responsible for over 85% of these infections. A 1994 study showed that 4.3% of all HCV infections were transfusion-related. This meant a per unit risk of 0.45% of acquiring HCV infection. With the advent of first-generation tests for screening of HCV, this risk fell to 0.06%; the advent of second-generation tests brought the risk to between 0.02% and 0.05%. Now, with the use of even more sensitive third-generation tests, ongoing prospective studies have yet to show any infection of recipients of recently screened products. These results are only preliminary, but they underscore the increasing safety from HCV of the present blood supply in the United States.

There has also been a tremendous amount of success in preventing infection with Hepatitis B Virus (HBV) from blood transfusions. Inactivation procedures have resulted in the infection rate plummeting after infusion of labile clotting factors (where HBV infections were nearly invariable because they are pooled from several donors). Despite the fact that, on average, 5.7% (and much higher in some areas) of the population is seropositive for HBV, the American Red Cross annually reports less than 100 cases of transfusion-related HBV infection in the approximately 2 million patients receiving transfusions. A recent Centers for Disease Control report estimated this risk to be approximately 1 in 200,000 transfused units (0.0005%), and a recent Canadian study found no serological evidence of transfusion-transmitted HBV infection. With continued donor screening, sample testing, and widespread immunization, these risks should continue to approach 0%.

Another DNA virus that is of special concern is cytomegalovirus (CMV). CMV is extremely prevalent, with seropositivity rates ranging from 20% (in developed but sparsely populated areas) to near 100% (in underdeveloped areas and large, densely populated urban areas). Recent studies in surgical patients have found that transfusion-related CMV infection incidences range from 15% to 30%. When previously CMV negative autologous transplant patients were given blood unfiltered or unscreened for CMV, a 23% seroconversion rate was reported. For patients with previous CMV